including some of the most powerful springing beetles, namely *Cryptohypnus* (circumscribed in the manner indicated below). It is, however, clear that what is lost in firmness is gained in freedom of movement, inasmuch as the articulation thus modified allows the animal to stretch the prosternum much further back. We observe also that this bold feature in the structure of *Cryptohypnus* is combined with and compensated by the highest development of everything else which contributes to the springing-process, such as the long prothorax, elytra with raised ribs, &c., the small size (2 lines) of the animal being also an important element in this respect. No doubt this immense development of the springing-apparatus is calculated to suit the habits of the animal, because, living in sandy soil, they cannot depend either on firm support for the body in springing, or on a firm footing while running. In such localities these small "clickers" skip with such power (nearly a foot in height), with such rapidity, and so many times consecutively, that it is often difficult to catch them.

[To be continued.]

XXX.—*On the Homologies of the Male and Female Flowers of Conifers.* By Andrew Murray, F.L.S.

[Plate X.]

Notwithstanding the numerous analyses to which the flowers of Conifers have been subjected, the opinion of botanists regarding the significance of their parts is by no means unanimous. Any additional light upon the subject should therefore be welcome.

The hot and long continued summer of 1865 seems, by ripening the wood, to have induced a more plentiful flowering of Conifers this year than usual—many species which had not previously flowered, or at least not previously produced male flowers, having done so this summer. The study of some of these has presented the relations of the different parts to me in a clearer light than any in which I have hitherto seen them placed; and I venture to submit them to the reader in the hope that I may thus contribute to the clearing up of the difficulties which surround them.

If we take the male catkin of any Cypressine Conifer, say *Wellingtonia*, which is one of those which have produced male flowers in Britain for the first time this year, we find that it consists of a few scales (Pl. X. fig. 1), with small rounded balls peeping out between them. These scales are obviously a mere continuation of the scales of the branch; but on examining them minutely, we find that they are a little larger and broader, their margins somewhat laciniated instead of being smooth, their colour, instead of being green, yellowish fawn or pale brown, and their texture, more especially at the margins, petaloid. It is often difficult to tell whether an organ is a petal, a sepal, a bract, or a leaf; but, speaking in a general way, there are two characters which are rarely absent from petals, and help to distinguish them: one of these is colour, and the other a peculiar elongated cell-structure which does not, indeed, essentially differ from other cell-structures, but which has a different aspect and is easily recognized. We all know the texture of a petal; and where that texture is present, either in whole or in part, it furnishes a presumption that the organ possessing it is a petal. In Conifers it often suggests the fact at once where, but for it, the petaloid nature of the part could only be determined in some more roundabout and difficult way. For instance, in *Cunninghamia Sinensis*, where what is called the scale (but what in that particular instance is the petal) is, as plainly as can be, a continuation of the hard leaves of the branch, and, bearing stomata, traces of the petaloid structure will be found in the laciniated margin. So in *Wellingtonia* and all the Cypresses, the scales which form the male catkin, although merely the continuation of the leaves of the branch, are the petals, each petal being one flower, and the small rounded balls which peep out at their base are the anthers; these are sessile and grow at, along, or on the inferior margin of the petal, as shown in Pl. X. figs. 2 & 3. Of course it makes no difference physiologically whether they are sessile or grow upon longer or shorter filaments or foot-stalks. At first they grow facing inwards towards the axis; but by-and-by, probably from there not being sufficient space there, they are turned backwards, as shown in fig. 4. I should here observe that figs. 2 and 4 are respectively of *Wellingtonia* and *Sequoia sempervirens* (the flowers of which correspond in all respects), the former being what I observed first in *Wellingtonia*, and the latter what I saw at a somewhat later date in *S. sempervirens*. I have no doubt that if I had had the opportunity of observing *Wellingtonia* at the same later date, I should have found the anthers reverted as in the other, or that if I had thought of examining *S. sempervirens* at the earlier date, I should then have found the anthers facing as in fig. 2.

In firs and pines exactly the same arrangement subsists: the male flower assumes the form of fig. 5 when young, and of fig. 6 when full-grown and the anthers have burst and the pollen been shed. Fig. 7 shows the underside before it has burst; and the longitudinal line on each anther shows where it bursts, having previously thinned off, perhaps through having been rubbed by resting on that point against the upperside of the next anther. It will be seen how exactly the male flower when young (fig. 8) corresponds with the flower of *Sequoia sempervirens* and *Wellingtonia*. The petal in *Sequoia* is larger and of a stronger consistence, and its anthers are rounder and comparatively smaller; but the chief difference is that, in the firs and pines, the anthers on each side, although still sessile, have extended themselves backwards, and united to the flower-stalk, which has become more elongated. The petal is now called the crest of the anther, and its back is now spoken of as its front, the more prominent and more highly coloured side being exposed outwards; but the same arrangements remain as in the Cypresses. The petal or crest of the anther is more highly petaloid in structure than in the Cypresses, and its colour is usually more bright and rich; but, as in them, it is concave towards the axis and convex on the outer side. The stamens are sessile as before, and attached to the inferior margin of the petal; but the union is continued down the peduncle, which is comparatively longer; that is all the difference.

With the key thus given, it is impossible to misunderstand the homologies of the male flowers: they are monopetalous and diandrous in the firs and pines, monopetalous and polyandrous in the Cypresses and allied genera.

The female flower is also monopetalous. In the young state the petal is a small bract, sometimes green, sometimes even more richly coloured than the petal of the male flower, but always petaloid in texture, at least at the margins. Various authors have, from considerations of development and analogy, surmised the identity of this bract with the stamens in the male flower; but this is rather more than the truth. It is not with the stamens that they correspond, but solely with the crest which surmounts them, or, rather, from the base of which they spring. As it appears to me, it has no analogy, affinity, or homology either with the anthers or their peduncle.

This petal or bract is always present, so far as I have seen, although in the mature cone it is sometimes difficult to distinguish it. It is developed to the greatest extent in some of the silver firs, as *Picea bracteata* and *P. nobilis*. In the mature cedar it may be wholly overlooked, it having in it, by the pressure of the seed behind it, been reduced to a mere pale ragged scurf, interrupted in the middle. In the Cypresses it is often reduced to a mere membrane or crust. If we open a young green cone of *Wellingtonia* or *Sequoia sempervirens*, we see the space between the scales filled with a bright claret-coloured matter which looks like an exudation, fitting into the sinuosities of the scales. This is the petal; and if examined with a lens, the petaloid texture is very obvious: when the cone is mature, the petal has been converted into a film or crust. In the pines the petal takes the form of a small stiff bract, which in some is very plain in the mature cone, in others less so, or more or less squeezed or obliterated by the pressure of the surrounding scales.

Another evidence that this bract is the petal is the fact that, as in other flowers, it appears first, and remains for a short time before the seeds or their envelopes begin to show themselves. It is, no doubt, persistent both in the male and female flowers; but we have plenty of other flowers with persistent petals; and although it does not fall off at the same stage as in most other flowers, we can estimate the termination of its flowering by the appearance of the parts connected with the fructification inside of it.

In other plants the seeds are developed within the petal or petals, and their envelopes take their place in a determinate order or series of concentric layers. That order, I think, is preserved in the Conifers; and I shall first contrast the layers or envelopes which encircle the seed in ordinary dicotyledonous plants with what I consider the same parts in Conifers, and then take each of the parts separately and endeavour to show that they are what I suppose them to be. The envelopes, beginning with the petal and looking inwards, then, are as follows:—

	In ordinary dicotyledonous plants.	In Conifers.
1. Outermost envelope or its appendages.	Petal.	Bract.
2. Next envelope.	Disk.	Scale.
3. First covering of fruit.	Pericarp.	Wing of seed.
4. Second ditto.	Mesocarp.	Cellular substance between 3 and 5.
5. Third ditto.	Endocarp.	Testa.

The remaining envelopes of the nucleus of the ovule in the Conifers (primine, secundine, &c.) in no respect differ in appearance or function from those of other seeds, and therefore need not be specially noticed.

An examination of the above parts shows nothing inconsistent with the above distribution of function which I have assigned to those of the Conifers.

1. *The Scale.*

As with the stamens growing on the inferior margin of the male petal, the ovary takes its rise on the inferior margin of the female petal. Physiologically, perhaps its ultimate origin is to be referred further back; but this is the point where it comes into view. Its first appearance and subsequent growth have recently been fully traced by various physiologists; and I need not recapitulate their observations. I refer the reader to Payer's observations, Baillon's paper in the 'Annales des Sciences,' to Dr. Dickson's translation of a part of it and to his own observations on *Dammara* and *Araucaria* in the Transactions of the Botanical Society of Edinburgh, for details on the growth and development of the ovary.

Figure 18, copied from one of Baillon's figures of the germ in its earliest state, shows its appearance when the wing begins to manifest itself. The bract lies behind the scale, its margin being just visible over the top of it. The position and appearance of the germ at this stage is, to my mind, proof that it is equivalent to the pistil. The two ears are the commencement of the pistil.

Prof. Caspary, in a paper in the 'Natural Hist. Rev.' (1862), expresses his dissent from Baillon's observations. He has made similar investigations on allied species, and not got the same results. He found, in the larch, that what Baillon calls the ovule appeared first "in the shape of a hemispherical boss, around which, some weeks later, the integument is produced, not in the form of two distinct horseshoes, but of a complete ring, uniform in height all round;" and therefore he held that it was the nucleus of the seed, and that what becomes the wing was one of the integuments of the ovule. *So it is,* no doubt; but it is the outer integument of the ovule—that is, the pistil or pericarp. All the other integuments can be traced within. I rather look upon Caspary's objection as affecting the question whether the wing &c. is a converted dicarpellary leaf or a converted single carpellary leaf than whether it is a carpel at all.

I may, however, say one word in support of Payer and Baillon's observations. Founding on his observation on the larch, Prof. Caspary says, "As it is incredible that the integument of *Pinus Larix* should from the first be a regular ring, while that of the other Conifers examined by M. Baillon presents in its earliest condition the appearance of two horseshoes, the observations of MM. Baillon and Payer appear to me more than doubtful." But it is not alone the observations of Payer or of Baillon, nor the confirmation of them by Dr. Dickson, that would require to be set aside; the very same thing was seen and figured by the older writers. Lambert figures it very distinctly, in his genus *Pinus,* as present in the cedar, and so does Richard in his monograph 'De Coniferis, &c.;' and as he also figures different modifications of it, we may be allowed to hope that the different appearances are not so irreconcilable as Prof. Caspary supposes.

I think I find an unintentional and indirect support of the view I have taken of the nature of the scale in one of the results announced by Baillon. No doubt we differ in some respects. He holds, and so do I, that the fructification of Conifers is not gymnospermatous, but that it possesses a true dicarpellary ovary; but he holds also that it is without floral envelopes, in which, as already said, I do not agree. But the inference he arrived at which has most interest to me is, that "the cupule, of various consistence and form, which surrounds the ovary, and which in several genera has received the name of aril, is a later production, although anterior to fecundation, as is the case in those floral organs (resulting from an ulterior expansion of the axis) *which have been termed disks.*"

This seems to mean that the cupule of the yew is a disk. I so hold it, and regard it as the homologue of the scale in the pines; only, the flower being here solitary, the seed is wholly surrounded by the disk, instead of, as in the pine (where it is not solitary), being confined to one side, its place on the other being supplied by the back of the next disk, on which it leans. If Baillon also meant to include the scale of the pines under the term cupule, then he has anticipated me in the view which I now propound, and I must content myself with the ejaculation "Pereant qui ante nos nostra dixerunt." But I think I may (indeed, in the interest of the hypothesis, I *ought* to) state that my view is neither borrowed nor adapted from that of Baillon: I arrived at it by the route I have above pointed out; and it was only on turning back to Baillon's paper, in order to verify my statement of his other views, for the purpose of this paper, that I noticed the bearing of the passage above quoted.

Thus arrived at by independent minds, and by a different course of reasoning, the probability of its being the true solution is materially strengthened.

If, then, the bract is the petal and the wing of the seed the pistil, what is the scale? It cannot be the pericarp (which is the most tempting and natural-looking idea), because the pericarp must necessarily be one of the coats of the pistil. There is only one thing that it can be; and that is, the disk. The definition of a disk is, that it is whatever intervenes between the stamens and the pistil. To be sure, we have no stamens here; but we know very well where they should be if the flower were hermaphrodite, viz. springing from the base of the bract behind the scale; so that by no contrivance could they come between the scale and the germ growing on its base.

The scale must therefore be the disk. That organ assumes great variety of form, such as scales, hairs, glands, petaloid appendages; but that form which seems most parallel to the present case is the inner lining of the hip of the rose. In fact the fruit of the Conifer is a hip whose disk, instead of enclosing the seed all round, lies, like the petal, only on one side; and the reason is plain. Nature sets us all an example of economy. If she were about to build a house, and the gable of another house would serve for one of its walls, she would never be at the wasteful expenditure of building a second wall parallel to it, but would use the old gable to save space and expense. She has done so in the Conifers; she has built her wall of disk leaning on the back of the next disk, making its back wall serve for the front of her house, as shown in the section (fig. 17).

The same one-sided arrangement follows into the seed; but there it appears to be the result of its position and the physical or mechanical consequences of the growth of the parts about it. At first a mere rounded carpel with the apex of the pistil looking downwards, it is soon compressed and flattened by the growth of the scale outside of it and of the neighbouring scale inside of it, and the epicarp dragged forward or pushed up (or, what is the same thing, the growth is inclined in that direction) so as to form the wing; and this in most cases is carried on until it has left the endocarp itself bare on the inner side, and sometimes partially and at others wholly bare on the outer side too.

Looking at the scale in the above light, it may be desirable to note one or two points in its structure and development which, I think, have been overlooked. Not that they perhaps have any bearing upon the question of its being a disk, but merely to make a jotting of the facts.

In pines and those Conifers which have an exposed apophysis and mucro, the first part of the scale which appears is the mucro of the apophysis. Fig. 9 shows the young female cone of *Wellingtonia* much magnified; and figs 10 and 11 represent an individual scale seen from the exterior and sideways, with the young seeds hanging from it on the inner side. At this stage it is very apt to deceive the observer as to its homology, seeing that it is not much larger than the male petal, and, like it, apparently a continuation of the scale-like leaves of the branch: one's first idea naturally is that it is the homologue of the male petal; but on examination, besides finding the true claret-coloured petal behind it, we fail to perceive the petaloid texture at the margin; the margin is not laciniated, and the texture is the ordinary cell-texture of the leaf.

The subsequent growth of the scale is chiefly from the base. This is the case with leaves too. The point of a leaf never increases much in size; it is the middle or posterior half where the chief growth takes place. In the male flower we have seen that it is the peduncle which elongates, increasing and extending the dimensions of the anther with it, but carrying on the petal or crest of the anther at its extremity without materially adding to its size; so the same process of growth takes place here. The apex of the scale is pushed on by the growth of the lower part of the scale, and its shoulders are filled out and distended, by the accumulation of cell-growth behind them, until they assume the form of a mature apophysis. It is in consequence of the growth of the scale taking place in this manner that in some Conifers, as the firs and pines, we have the seeds growing upright in an orthotropal manner from the base of the scale, while in others, as *Wellingtonia* and *Sciadopitys,* they hang down from the upper part of the scale. The point of insertion of the seeds is obviously close upon the boundary line where the growth of the scale commences to act with vigour. If it be below it, the seeds grow upwards, being determined in that direction by their base or foundation being as it were pushed downwards, and the body of the scale, by its lengthening upwards, giving an inclination to the seed resting on it to follow in its growth the same direction. If the insertion, on the other hand, is above the point of growth, their base, being attached to the body of the scale, is carried upwards with it, and their apex is turned downwards by the upward growth of their point of insertion, as, indeed, they could not well grow in any other direction. If I am right in this interpretation of the cause of the seeds in some species growing up, and in others growing down, it deprives that fact of much of the significance which systematists have sought to attach to it.

The growth of the scale is strengthened in the interior by a woody core; but here, too, its appearance is very apt to mislead us. Figs. 12 and 13 represent respectively the core of a scale of *Wellingtonia* and of a fir. It has a strong resemblance to the flat branches which we often see in distorted shoots of the spruce fir, where two or three twigs have become united; and hence many observers have adopted the view that the scale was only a converted branch: but every part of a plant is only a phase of another, all being referable to some modification of a leaf; therefore the analogy to be drawn from its branch-like core is no ground for holding the scale to be analogous to a branch. The same objection would apply to all pericarps having a woody core.

It is to be observed, too, that although in the pines and spruce firs this core remains, like a branch, and does not fall off like most other pericarps, in the silver firs it does become constricted at the base and drops off as they do.

The core is double, as is well shown in Richard's figures; but while apparently a double central stem, each of which we should expect to supply respectively the inner and outer halves of the scale, it is in reality allotted wholly to the inner half of the scale. Fig. 14 shows the apophysis of the scale in *Wellingtonia,* fig. 15 a section of a scale taken from a mature cone of that species, and fig. 16 a section of a scale of *Pinus patula*; and it will be seen that the posterior ligneous plate in both cuts in with rather an abrupt turn just behind the mucro. It would appear therefore as if the greater strength was apportioned to the inner portion of the structure rather than to the outer, which is just what we find in other nuts, such as the cocoa-nut, &c.

2. *The Wing and Envelopes of the Seed.*

I assume, then, as a fact already proved, that the covering of the seed of which the wing is part is the carpel. In discriminating its different parts, the only difficulty is with regard to the mesocarp. The testa is, of course, the endocarp, equivalent to the stone of the peach or to the pip of the cherry. The wing is equally, of course, part of the epicarp. It is double, and, as already said, usually covers one side of the seed entirely, and more or less of the other side. In the firs, and especially the silver firs, it is folded like a sheet triangularly round the seed, leaving a portion at each end more or less exposed. There is, however, not much mesocarp; but if the wing in some species be cut across immediately above the seed, a moderate thickness of cellular substance will be found there. This I consider the mesocarp, which thins off on either side.

Within the carpel are found, in Conifers as in other plants, the ovule, consisting of a nucleus enclosed in its two coverings, the primine (the outer) and the secundine (the inner), as difficult to distinguish as in other plants, but not more so; and the tercine, quartine, and quintine of Mirbel, representing respectively the albumen of the cotyledons, the circumvolution of the embryo-sac, and the embryo-sac itself, are, of course, there too.

There remains to say one word, and only one, upon the corpuscles in the ovule. It appears to me that their significance has not been fully apprehended. The corpuscles or embryo-sacs, rightly taken, are the young cotyledons; and to say that an ovule has only two cotyledons is merely saying in other words that it has only one embryo-sac; or to say that it is polycotyledonous, is equivalent to telling us that it has corpuscles in the ovule. Brown says upon this point, "that each of these opaque bodies terminating the trunk and branches of the funiculi are really rudimentary embryos, is proved by tracing them from their absolutely simple state to that in which the divisions of the lower extremity become visible, *and those again into the perfect cotyledon.*"

This, therefore, is a character of the Gymnospermata which must be withdrawn by those who wish to retain *Gnetum, Ephedra,* or *Welwitschia* in the same group as the Conifers and Cycads. I do not; but to give my reasons for that would be to open another phase of the subject, which it is not my intention to enter upon here.

XXXI.—*On Green Oysters.* By ARTHUR W. E. O'SHAUGHNESSY, of the British Museum.

PLINY tells us of red oysters being found in Spain, of others of a tawny hue in Illyricum, and of black ones at Circeii, the latter being, he says, black both in meat and shell. Moreover these black oysters seem to have borne the palm of excellence in ancient times, being mentioned by various writers, amongst whom we may cite Horace; and, in spite of Mucianus, who tries hard to puff the oysters of Cyzicus as "larger than those of Lake Lucrinus, fresher than those of the British coasts, sweeter than those of Medullæ, more tasty than those of Ephesus, more plump than those of Lucus, less slimy than those of Coryphas, more delicate than those of Istria, and whiter than those of Circeii," Pliny records it as an ascertained fact that there were no oysters fresher or more delicate than those of Circeii. So much for *black* oysters, which we have never seen, and do not wish to deal with at present. Green oysters seem to be a more modern invention, and, as far as we can learn, are in many cases thoroughbred "young natives"—that is, *Britishers,* which appear to have made a rather unfavourable impression on the palates of our neighbours across the channel.

Some time ago a considerable excitement was created in France by the story of certain luckless individuals, who, having eaten of poisonous green oysters in the market at Rochefort, suffered accordingly. Upon inquiry, it was found that these oysters came from Marennes, on the west coast of France. Now Marennes has long been famous for green oysters; but, by the united exertions of the mayor of Marennes and his secretary, M. Bourricaud, the fact was elicited that *poisonous* green oysters came from Falmouth, in Cornwall. In a letter to the 'Moniteur,' on this subject, M. Bourricaud showed how "the enormously increased demand for the green oysters of Marennes, so justly renowned for their delicacy, had rendered the oyster-banks of that coast insufficient to supply the beds"—how, under these circumstances, it had become necessary to have recourse to Spain, Brittany, England, and Ireland—and how the young natives from Falmouth were not deemed presentable until they